Device, System, and Method for the Automatic Configuration of a Network Communications Device

Cross-References to Related Applications

[1] This application claims priority to, and incorporates by reference herein in its entirety, pending United States Provisional Patent Application Serial No. 60/436,302 (Attorney Docket No. 2002P20760US), filed December 23, 2002.

Background

[2] Control systems, for example those utilizing computers such as programmable logic controllers (PLCs), can control a broad number and type of devices, including alarms, indicators, actuators, motors, relays, and even input devices, such as sensors. Sometimes, such PLC's are located in remote locations, some of which are accessible via a cellular communications network.

[3] To program, communicate with, and/or receive data from such a remote PLC, a user can access a local user interface device, such as a personal computer, which can be coupled via the cellular telephone network to a cellular modem coupled to the remote PLC. A power failure can cause the remote cellular modem to re-start. If the remote cellular modem requires that a password or other security code be entered at start-up in order to operate, a human local to the cellular modem typically must provide that security code to the modem. Only then can the modem be operable, and the connection established between the user's computer and the remote PLC.

Brief Description of the Drawings

[4] The invention and its wide variety of potential embodiments will be more readily understood through the following detailed description, with reference to the accompanying drawings in which:

FIG. 1 is a block diagram of an exemplary embodiment of a system 1000; and

FIG. 2 is a flowchart of an exemplary embodiment of a method 2000.

Detailed Description

[5] **FIG. 1** is a block diagram of an exemplary embodiment of a system 1000. As illustrated, system 1000 can comprise a programmable cable 1100, which can have a first end 1101 and a second end 1102. In an exemplary embodiment, first end 1101 of programmable cable 1100 can be couplable to a network 1200. Second end 1102 of programmable cable 1100 can be connectable to a network communications device 1300, potentially via a port 1310. Network communications device 1300 can be connectable to a user interface device 1500 by a connection 1350. User interface device 1500 can comprise a telephone, modem, cellular telephone, cellular telephone modem, desktop computer, laptop computer, personal handheld computing device, workstation, minicomputer, mainframe, and/or any other programmable state machine. Connection 1350 can be a wireless device or connection; a wired connection, such as a twisted pair of wires, an coaxial cable, an optical fiber, and/or any other network wire, cable, or fiber; a network, such as a telephone, DSL, cable, wireless, public, private, switched, packet, local area, wide area, virtual, Internet, intranet, and/or other network; and/or any other connective media or connection type, etc. In an exemplary embodiment, network communications device 1300 can be intrinsic to user interface device 1500.

[6] Network 1200 can be couplable to a computer 1400, such as a programmable logic controller (PLC), via a network connection cable 1450, which can comprise a first end and a second end. Both ends of network connection cable 1450 can be connectable to an RS485 interface. Computer 1400 can be connectable through an intrinsic RS485 to the first end of network connection cable 1450. The second end of network connection cable 1450 can be connectable to network 1200, such as a ring-type network, e.g., a token ring network. In an alternative exemplary embodiment, PLC 1400 can be directly connectable through an intrinsic RS485 connection port to first end 1101 of programmable cable 1100.

[7] In an exemplary embodiment, port 1310 can be connectable to an RS232 interface. As used herein, the terms "RS485" and "RS232" refer to Electronics Industry Association interface standards for data communications connections. Alternatively, the

port 1310 can be connectable to a USB interface. As used herein, the term "USB" refers to a Universal Serial Bus standard used for data communications. Network communications device 1300 can be a modem, such as a telephone modem, DSL modem, cable modem, wireless modem, etc.; network card; computer; and/or any other networkable communications device. Additional user interface devices 1500 can be couplable to one or more network communications devices 1300, any of which can be connectable to network 1200 via one or more programmable cables 1100. Likewise, multiple computers 1400 can be connectable to network 1200 in certain exemplary embodiments.

[8] Devices connected to network 1200 can be controlled by a token passing technique. Programmable cable 1100 can serve as a token holding master device for network 1200. Programmable cable 1100 can serve as a means of communication between the PLC 1400 and user interface device 1500.

[9] In an exemplary embodiment, programmable cable 1100 can be configurable with parameters that can enable communications between computer 1400 and network interface device 1300, between programmable cable 1100 and user interface device 1500, and/or between computer 1400 and user interface device 1500. Setting at least one of a plurality of configuration parameters can configure a programmable cable 1100. A mode as defined in a mode table 1 can be a configuration parameter. In an operational embodiment, the programmable cable 1100 can be configured to either a first mode or a second mode of operation.

Mode Table 1

Freeport/PPI Mode Switch	
Setting	Description
0	Freeport mode
1	PPI mode

[10] The programmable cable 1100 can be connectable to certain intelligent sensing devices such as a bar code reader, certain PLCs, a modem, and/or a printer, etc. when the programmable cable 1100 is operating in a freeport mode (freely programmable character protocol). In an operating embodiment, when configured in the freeport mode, the programmable cable 1100 can be further configured by selecting a PPI protocol from a protocol table 2. As used herein, the term "PPI" refers to an industry standard point to point network communications protocol that can be a used in a token ring network. The token ring network can comprise at least one of a plurality of token holding master devices. In the freeport mode, a programmable cable 1100 can be configured by setting a PPI protocol comprising either a first PPI protocol or a second PPI protocol. The first PPI protocol can enable 10 bit communications. Alternatively, the second protocol can enable 11 bit communications.

Protocol Table 2

11 Bit/10 Bit Protocol Switch	
Setting	Description
0	11 Bit
1	10 Bit

[11] Programmable cable 1100 can be configurable to a PPI mode. The PPI mode can comprise a protocol wherein the programmable cable 1100 is adapted to, in an operative configuration, serve as a token holding master on the network and can enable multiplexed networked communications with the computer 1400.

[12] A locality mode can be a configuration parameter for the programmable cable 1100. The locality mode can comprise either a first locality mode or a second locality mode selectable from a locality mode table 3. The first locality mode can define a local programmable cable operation. In an operative embodiment, the programmable cable 1100, when in the first locality mode, can be configured by setting a plurality

programmable cable 1100 parameters. In an operative embodiment, when in the second locality mode, the programmable cable can configure a network communications device 1300 by communicating configuration information comprising a network communications device setup string and a PIN number.

Locality Mode Table 3

Local/Remote Switch	
Setting	Description
0	Local (DCE)
1	Remote (DTE)

[13] A data transfer speed can be a configuration parameter for the programmable cable 1100. The data transfer speed can be selectable from a speed table 4. In an operative embodiment, the data transfer speed can be communicated to the programmable cable 1100 as a set of three sequential bits defining a setting from 0 to 7 when converted to decimal form. The programmable cable 1100 can be configured to transmit data at approximate baud rates comprising 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200, etc.

Speed Table 4

Baud Rate Switches 1 2 3	
Setting	Baud Rate
0	38400
1	19200
2	9600
3	4800
4	2400
5	1200
6	115200
7	57600

[14] A communications language can also be a programmable cable 1100 configuration parameter. The programmable cable 1100 can be adaptable to communicate in any one of several languages with at least one user interface device 1500. The programmable cable 1100 can be configurable by selecting the communications language from a language table 5. A programmable cable 1100 can be configurable to communicate in any language, such as for example, English, German, French, Italian, Spanish, or Chinese, etc.

Language Table 5

Language Configuration	
Setting	Language
1	English
2	German
3	French
4	Italian
5	Spanish
6	Chinese

[15] The network communications device setup string can be a configuration parameter for the programmable cable 1100. The network communications device setup string can be comprised of a set of alphanumeric characters defining a communication protocol and/or a set of communication rules when transferred to at least one of a plurality of network communications devices. The network communication device setup string can configure the network communication device with a variety of settings comprising enabling incoming call answering, identifying the number of rings prior to answering an incoming call, enabling outgoing call dialing, establishing a port device communication protocol, selecting pulse or tone dialing, selecting or deselecting a command echo, requesting device specific information, and/or establishing device

register settings, etc. An exemplary embodiment of the network communications device setup string can be selected from a setup string table 6. For example, selecting a string ATS0=1 can enable the network communications device 1300 to automatically answer on the first ring. Selecting a string AT+CPIN=12ab can provide the PIN number to the network communications device in an operative embodiment.

Setup String Table 6

Typical AT Commands	
AT Index	String
1	ATS0=1
2	AT+CPIN=12ab

[16] In an exemplary embodiment, the PIN number can be supplied by the programmable cable 1100 to the network communications device 1300 to allow operation of network communication device 1300. In an operative embodiment, a configured and/or operable network communications device 1300 can allow communications between user interface device 1500 and computer 1400.

[17] In certain embodiments, the network communications device 1300 can comprise a subscriber identity module (SIM). The SIM can be a memory device that stores information comprising a subscriber's identification information and networks where the subscriber is entitled to service. The SIM can require a PIN to activate service. SIMs can be available as "smart cards" (credit card sized cards that can be inserted into any compatible device) or plug-in modules. In certain embodiments, the network communications device 1300 can be inoperable without the SIM. The SIM can be compatible with a variety of devices such as telephones, modems, etc., including hotel telephones, public telephones, any other portable or mobile telephone, and/or an analog, digital, cellular, wireless, DSL, and/or cable modem, etc. The existence of a SIM that requires a PIN to operate can discourage the unauthorized use or theft of the SIM and/or the network communications device 1300.

[18] In an operative embodiment, the network communications device 1300 can be installed or power-cycled subsequent to installation which can result in an unconfigured network communications device 1300. An unconfigured network communications device 1300 can require the power cycling of the programmable cable 1100 for the purpose of configuring the network communications device 1300 by supplying parameters comprising the PIN number.

[19] The programmable cable 1100 can be configurable with other settings and/or values in an exemplary embodiment.

[20] The programmable cable 1100 can comprise a first status indicator, a second status indicator, and a third status indicator. The status indicators can be lights and can be operable in a manner as in a status indicator table 7. The first status indicator can be operable to indicate data transmission through the RS485 connector. The second status indicator can be operable to indicate data transmission from the programmable cable 1100 to the user interface device. The third status indicator can be operable to indicate data transmission from the user interface device to the programmable cable 1100.

Status Indicator Table 7

LED	Color
Tx	RS 232 Transmit Indicator
Rx	RS 232 Receive Indicator
Xmt	RS485 Transmit Indicator

[21] In certain operative embodiments, programmable cable 1100 can be adapted to encrypt and/or decrypt data communicated between programmable cable 1100 and user interface device 1500, computer 1400 and programmable cable 1100, and/or the computer 1400 and user interface device 1500. The encryption and decryption of data can prevent unauthorized data reception, transmission, and/or use. Similarly, the

programmable cable 1100 can be adapted to filter communications thereto and/or therethrough, in a manner similar to that provided by firewalls and virus detection software.

[22] In certain exemplary embodiments, a controller or any portion thereof (processor, memory, interface, etc.) incorporated in the programmable cable can be located within and/or adjacent to the housing of an end connector of the programmable cable. Thus, the controller can be of sufficiently small size to be hidden in a housing that appears normal in size, thereby potentially disguising the programmable cable as an "ordinary" cable, and potentially preventing recognition to an untrained observer that the programmable cable is possibly needed to render the network interface device operational.

[23] **FIG. 2** is a flowchart of an exemplary embodiment of a method of use. Note that, unless specified otherwise, no particular activity of flowchart 2000 is required, and no particular sequence of activities is required. Thus, any activity shown on flowchart 2000 can be omitted and/or the sequence of activities can vary. In an exemplary embodiment, a programmable cable can be used according to flowchart 2000.

[24] At activity 2100, the programmable cable can be initialized using the user interface device. The programmable cable can be initialized by setting at least one of a plurality of programmable cable parameters comprising: the mode of operation selected from the first mode of operation and the second mode of operation, the PPI protocol selected from the first PPI protocol and the second PPI protocol, the cable locality mode selected from the first locality mode and the second locality mode, the data transfer speed, the communication language, the network communications device setup string, and/or the PIN number.

[25] At activity 2200, the programmable cable at least one of a plurality of configuration parameters with at least one of a plurality of network communications devices. Thus, the programmable cable can automatically configure the network communications device. For example, during and/or subsequent to power-up of the

programmable cable and/or the network communications device, the programmable cable can automatically provide a PIN number to enable the network communications device to function. The automatic configuration of the network communications device can take place when the network communications device is power-cycled.

[26] At activity 2300, at least one of a plurality of user interface devices can communicate with the PLC via the programmable cable.

[27] Still other embodiments of the present invention will become readily apparent to those skilled in this art from the above-recited detailed description of certain exemplary embodiments. Accordingly, the drawings and descriptions are to be regarded as illustrative in nature, and not as restrictive.